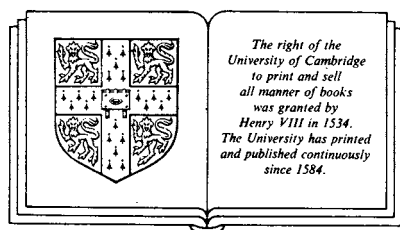

INVENTING THE INDUSTRIAL REVOLUTION

The English patent system, 1660–1800

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CAMBRIDGE UNIVERSITY PRESS

Cambridge

New York New Rochelle Melbourne Sydney

PUBLISHED BY THE PRESS SYNDICATE OF THE UNIVERSITY OF CAMBRIDGE
The Pitt Building, Trumpington Street, Cambridge, United Kingdom

CAMBRIDGE UNIVERSITY PRESS

The Edinburgh Building, Cambridge CB2 2RU, UK
40 West 20th Street, New York NY 10011-4211, USA
477 Williamstown Road, Port Melbourne, VIC 3207, Australia
Ruiz de Alarcón 13, 28014 Madrid, Spain
Dock House, The Waterfront, Cape Town 8001, South Africa

<http://www.cambridge.org>

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First published 1988

First paperback edition 2002

A catalogue record for this book is available from the British Library

Library of Congress Cataloguing in Publication data

MacLeod, Christine.

Inventing the Industrial Revolution: the English patent system.

1660-1800 / Christine MacLeod.

p. cm.

Bibliography.

Includes index.

ISBN 0 521 30104 1

1. Patents – Great Britain – History – 17th century. 2. Patents –
Great Britain – History – 18th century. I. Title.

T257.P2M33 1988

346.4104'86-dc19

[344.106486] 87-37406 CIP

ISBN 0 521 30104 1 hardback

ISBN 0 521 893992 paperback

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INTRODUCTION

The English patent system is both older and younger than we tend to think. Patents for invention have been granted regularly since the middle of the sixteenth century, but it was not until 1852 that the first major legislation on patents was enacted by parliament and the Patent Office established. Between 1660 and 1800 the 'patent system' was something of a misnomer. It was not the orderly protector and promoter of inventions that one steeped in the patent law of the twentieth, or late nineteenth, century might imagine. Yet neither was it the corrupt dispenser of Court patronage that one whose perspective was the early-Stuart monopolies controversy would perhaps expect. This study starts by explaining how a recognizable patent *system* emerged from the monopoly muddle. The Statute of Monopolies (1624), enacted in an attempt to curtail the crown's abuse of patents, exempted from its general proscription those granted for new inventions. Contrary to the impression often given, this essentially negative piece of legislation was insufficient by itself to produce an institution at all capable of meeting the needs of the inventors of the industrial revolution. Development was gradual and quiet: there was no legislation, little activity in the law courts, and only muffled sounds to be heard from a few books and pamphlets. For a long time, the system's survival was precarious: invention took place outside it and often in ignorance of it. It survived, in the first place, because enough people found a use for a patent beyond simple protection of an invention and, eventually, because in using it they created an institution that took on a life of its own, which they could not ignore. Soon after the middle of the eighteenth century the system developed its own momentum and promoted a first-strike mentality among its users: one neglected to patent at one's peril. Change came through the initiative of its 'customers' and the response of its administrators to the uses and abuses discovered for it.

This book is not concerned simply to provide an administrative history of the patent system. It explores the relationship between patents and inventions in seventeenth- and eighteenth-century England, and suggests a more fruitful role for the patent records than those to which they have usually been reduced. Invention and its contribution to economic growth are slippery

subjects to grasp. To the historian grappling with the elusive problem of productivity growth in the eighteenth century, patents for invention have seemed to offer a firmer grip, a quantitative supplement to inconclusive, qualitative evidence. But danger notices have been posted; we have been repeatedly warned away and told not to put too much weight on patent statistics.¹ Marshalled into serried ranks of gross figures, as a crude index of either inventive activity or technical change, the patent statistics are, at best, misleading. Used with appropriate historical sensitivity, however, they can illuminate a range of economic and social developments. If this book does nothing else, it should finally undermine all attempts to build tall superstructures on the fragile foundations of the patent statistics. But I hope it will do more, of a more positive nature. For the patent records remain one of the few consolidated sources of information about inventors and their activities, before the nineteenth century, that we possess. It is not my intention to dismiss the patent system, but to explore it: to demonstrate how it worked and was used; to discover who the patentees were and how they exploited their grants; to assess the extent of inventiveness both inside and outside the scope of its records; to investigate how it was regarded by contemporaries and what we may learn about their attitudes to invention. In the words of Jacob Schmookler, 'we have a choice of using patent statistics cautiously and learning what we can from them, or not using them and learning nothing about what they alone can teach us'.²

Patents for invention were, until the late eighteenth century, a small minority of all letters patent filed (letters patent being a regular administrative instrument for the granting of lands, titles, offices, and other privileges). This complicates the task of tracing them. Fortunately, it has already been done. All researchers are indebted to Bennet Woodcroft, the first head of the Patent Office, who undertook this Herculean labour, tracked down the vast majority of them, and in 1854 published his work in three indexes. They and the blue books containing the texts of these patents, published by the new Patent Office shortly afterwards, must be the starting point for all subsequent research.³ To understand the workings of the patent system, however, one must delve, beyond these printed registers with their deceptively regular appearance, into the morass of documents which trace the labyrinthine course through the government bureaucracy that a would-be patentee had to steer. Together, these petitions, warrants, reports, and dockets, held in the Public Record Office, amplify the barely audible tread of administrative development. Sadly, however, their impressive bulk is misleading: it is chiefly bureaucratic replication, revealing little about patentees and their inventions or projects. In this period the English patent system was one of registration, not examination.⁴ Scrutiny of applications for patents was minimal, and information about them is accordingly sparse. Before the introduction of written specification in the early eighteenth century, and sometimes also after it, even the subject of the patent is shrouded in secrecy

and only briefly described. And it is only from the same period that patentees regularly recorded their occupation and place of residence. There is a sharp contrast here with, say, the French archives, which contain a wealth of detail about the personal backgrounds, inventions, and enterprises of those seeking a *privilege*. The difference arises from the fundamental distinction between the two institutions: while the French government needed to know which applicants were worthy of its financial and other assistance, the English government was issuing a permission in which it had no further stake and whose value rested entirely on market forces.⁵

Researchers into the English patent system have to look more widely than the system's own records. There is no other consolidated source: it is a matter of tracing individual patentees and inventors. If a patentee suffered the unhappy fate of a legal case, court records sometimes reveal further material about him and his invention. A case law on patents only began to develop in the second half of the eighteenth century. Earlier cases and those in which no precedent worth recording was established are not easy to unearth. I have chanced on a number, most of them in the equity courts, which are discussed in chapter 4. A systematic search of the indices to Chancery and King's Bench would doubtless reveal more. Parliament occasionally discussed individual patents, when the patentee sought an extension of his term or a private Act to give him stronger powers: reports are to be found in the journals of the two Houses, and abbreviated debates in Cobbett's *Parliamentary history*.⁶ Pressure for reform of the patent system in the early nineteenth century was finally released through the safety valve of a select committee inquiry: since the system was still essentially the same as the eighteenth century's, some information can be gleaned from the evidence given to the committee.⁷ For the rest, one is dependent entirely on literary sources. A very few patentees, like John Wyatt and James Watt, left letters and business records. Some, Thomas Savery for instance, wrote tracts to promote their inventions; others were attacked in print by rivals and victims of their monopolies and failed projects.⁸ The seventeenth and eighteenth centuries did not see inventors in the heroic light characteristic of the nineteenth. Contemporary accounts of either enterprises or personalities are consequently rare, while the next century's retrospective hagiography is often inaccurate. Fortunately, there is a growing secondary literature, both biographical and technological, which often produces valuable nuggets of information. Indeed, I have been dependent throughout on the careful researches of many historians who have shed light on the technologies and industries to which patents referred.

Most of the existing 'standard histories' of the patent system were written by lawyers or economists with present-day causes to plead. J. W. Gordon in 1897 was anxious to defend 'the public against the abuse of patent right'; fifty years later, H. G. Fox thought that judges were being too harsh on patentees, demanding some mysterious component of 'inventive genius', unintended by those who originated the system. Both looked to the Statute of Monopolies

(1624) for clarification of patenting's historical function, and largely ignored the late seventeenth and eighteenth centuries. In 1906 William Hyde Price investigated the history of monopolies and patents under the Tudors and early Stuarts from an economic standpoint. Again he ended the story in 1640, drawing some timely conclusions about monopolies, no doubt in the light of current anti-trust legislation in the United States.⁹ Allan A. Gomme, of the Public Record Office, in 1946 produced a straightforward, if brief, administrative history of the patent system from the late middle ages to the twentieth century.¹⁰ This succeeded a series of articles in the *Law Quarterly Review*, by E. Wyndham Hulme and D. Seaborne Davies, which made an important contribution to the administrative and judicial history of the subject.¹¹ In 1967 Boehm and Silberston, researching 'the economic effects of the British patent system', found it necessary to devote considerable space to elucidating not only the legislative position but also the history of the patent system.¹² Their synopsis of the early history, however, is brief and concentrates again on the Statute of Monopolies; their historical emphasis is on the reform of the patent system in the nineteenth century and its subsequent sophistication.

If historians of the patent system have failed to account for what happened to it between 1640 and 1852, historians of the industrial revolution have not been deterred from speculating on its economic consequences – and reaching widely variant conclusions.¹³ It is only recently that an economic historian has studied this question in depth. Harry Dutton went beyond administrative and legal history to look at inventive activity for its own sake and 'to see what effect patents had on those who used the system'.¹⁴ With an ingenious model of an 'infant invention industry', he reached the conclusion that the very imperfections of the system 'paradoxically, created something close to the ideal'. Inventors used it because it was the only protection available to them, yet it was insufficiently watertight to prevent the fairly rapid diffusion of new techniques.¹⁵ Dutton's work illuminates the late eighteenth century, and I make frequent references to it here, but his emphasis was on the first half of the nineteenth. There remains more to be said about the earlier period, which is perhaps only visible if it is approached travelling forward from the seventeenth, rather than in reverse from the nineteenth century.

Otherwise, early patent records have usually been treated either as a source to be mined for names and dates to attach to inventions, or as a shabby but serviceable index of inventive activity. The former has its dangers, in encouraging an heroic view of technical change,¹⁶ the latter, which I shall examine more closely, has been a false trail. Now econometric history has taken the pressure off patents.¹⁷ Its far more sophisticated calculations are at hand to investigate the rate and direction of technical change during the industrial revolution. There is the further advantage that econometric studies, by focusing on productivity increase, take us more surely into the economic consequences of technical change. Inventive activity, to which

patents provide only an approximate guide, is itself but the raw material; the economic historian is usually more interested in the extent and rate of an invention's diffusion and its consequences for productivity. No definitive answers have yet been produced: historians using similar econometric methods have reached quite different conclusions about the extent and nature of productivity growth.¹⁸ It is possible that a consensus will be reached; it is also possible that historians will finally conclude that calculation of 'the residual' (total factor productivity) is no more helpful than counting patents. As the term implies, the residual is what is left unaccounted for once inputs of land, labour, and capital have been deducted from output – 'a "best guess" and no more than that'.¹⁹ Both are attempts to quantify qualitative change. While they provide a valuable perspective, the historian is forced, in the end, to move back from measurement to judgement. In the case of the residual, it is necessary to assess how large a role was played by technical innovation *vis-à-vis* other externalities, such as organizational improvements or education of the labour force.²⁰ In that of patents, we are forced to enquire which inventions, caught in the system's net, were the crucial ones, and to estimate whether there were economically important inventions, or indeed other externalities, unrecorded by a patent. There is no short cut.

The temptation to seize on the patent statistics as an indicator of inventive activity remains largely because the graph does exactly what our historical 'common sense' tells us it should. It shows a marked upward trend from the third quarter of the eighteenth century. From an average of 60 patents per decade in the century after the Restoration, the decennial total jumped to over 200 in the 1760s, to nearly 500 in the 1780s, and continued doubling every two decades to the mid-nineteenth century. The obvious explanation is that this rise expressed a sudden blossoming of inventive talent; it was the 'wave of gadgets' that notoriously swept the country in the late eighteenth century.²¹ That wave itself remains a source of controversy. Historians of technology disagree over whether there was a discontinuity in techniques sufficient to constitute a technological revolution; economic historians debate the role of technical change in economic growth. Akos Paulinyi has recently made the case for regarding the introduction of 'material-forming working machines' in manufacturing industry, particularly the invention of machine tools, as *the* technological revolution.²² His thesis challenges those who, like McCloskey and Von Tunzelmann, believe that technical progress in this period consisted, not in the famous new machines and engines, but in a host of small improvements – 'more like a gentle (though unprecedented) rain, gathering here and there in puddles' – and was evolutionary rather than revolutionary.²³ Emphasis on the diffusion of inventions, rather than their initial appearance, also tends to minimize the importance of the 'revolutionary' factory technologies of steam and cotton before the second half of the

nineteenth century. Raphael Samuel, in particular, has stressed the size of the unrevolutionized sector and its continuing dependence on human muscle power.²⁴

A gradual, evolutionary development starting in the sixteenth century, or earlier, is also espoused by those who follow Nef in regarding, not factories and their machinery, but the long-running shift from a wood-burning to a coal-burning technology as the crucial innovation.²⁵ Moreover, there has long been doubt among economic historians whether a bundle of striking technical inventions has not been mistaken for industrialization. Although important to a few industries, their economic impact was perhaps slight before the middle of the nineteenth century; the English economy grew fast, but did not achieve the sustained rise in per capita real incomes that may be taken as the defining characteristic of 'industrialization'. Recently 'the first industrial revolution' has been depicted as the concatenation of two distinct phenomena. Crafts, for instance, recognizes the major technical changes occurring in the 'modernized' sectors – the cotton and iron industries – but doubts their overall economic significance, at least before the 1830s: the revolution was chiefly in the structure of the economy, not in manufacturing productivity.²⁶ Wrigley argues even more strongly for expansion within a traditional economic and technical framework: the remarkable growth of England's eighteenth-century economy was based on 'organic' resources (the produce of the land); the full switch to an 'industrial inorganic' economy, based on coal and steam, was a post-1830 phenomenon.²⁷ Both Crafts and Wrigley regard agricultural productivity as the key to eighteenth-century growth, and technical change in industry as contingent and fortuitous. In Crafts's view, it was by chance that cotton-spinning machinery was invented in England rather than elsewhere; for Wrigley, England's coal seams were 'an uncovenanted blessing'.²⁸ The patent statistics cannot be employed to decide between these interpretations and none of these historians have called on their support. The answer, if there is one, lies elsewhere, in more detailed but also more wide-ranging, comparative and counterfactual investigations.

Yet the phenomenon represented in the graph persists and requires explanation. As the various series of figures which supported a 'cataclysmic' interpretation of the industrial revolution have been reworked and smoothed out,²⁹ patents' rapid late-eighteenth-century climb has remained one of the few steep ascents in a landscape of now gently rising hills. One might rework the patent series too, perhaps eliminating all but the 'technologically significant' inventions and taking note of important, unpatented ones.³⁰ This might of itself be a valuable exercise, but it would not provide a historically valid new series; we would simply be back in the realm of qualitative evidence. The patent statistics have to stand. The printed records are not complete and they contain some errors, but the omissions and inaccuracies are trivial: they provide no basis for any new insight.³¹ An imperfect series of statistics is not

the difficulty. The problem is two-fold. It is first that the patent system was a rag-bag institution: it contained many dubious minor improvements, variations and designs, while some of the most important inventions (for example, Newcomen's atmospheric engine, Huntsman's crucible steel, and Crompton's mule) were never patented. It is secondly that inventions themselves are not reducible to units to be totalled. They are 'fuzzy objects', like the peaks in a mountain range: it is difficult to determine where one ends and another begins. Attempts have been made to measure them in a variety of ways, none of them simple or straightforward. (Can technical achievement be put in the same scales as economic potential, for example? Which was more important, the initial breakthrough or the host of later, minor improvements that made it technically and economically feasible? How far was that breakthrough an illusion, the cumulation of many small steps? How does one count failed prototypes or the multiple inventions of the same product or process?)³²

An individual patent may mark a technical achievement. The significance of patents as a group, however, must be considered in economic terms. Collectively, eighteenth-century patents are indicative of points of economic growth in a competitive, capitalistic context. The patent statistics need reinterpreting, not recalculating. We have been asking them the wrong questions. If we cannot trust them very far as a guide to invention, let alone productivity increase, we can trust them completely as an index of patenting. This is not the tautologous dead end it appears to be. The timing and distribution of patents *qua* patents is suggestive of tensions within the economy, some acute, others chronic: the pressure of costs to be cut or of opportunities to be seized. Sometimes, but not always, these were pressure points amenable to technological relief; often they indicate a fashion for some consumer good, where technology's role was minor or nonexistent.

Whether inventors were motivated chiefly by the search for profit or by noneconomic factors, such as curiosity or 'an instinct of contrivance', has been the subject of a long debate, which has largely revolved around the work of Jacob Schmookler.³³ Whichever view of inventors in general is correct, patentees provide a special case. There was no glory attached to being a patentee. The purchase of a patent was a commercial transaction. Patents were expensive to obtain, and nobody sought them without an economic end in view. This aim might have been to protect and exploit an invention; or it might have been to impress potential customers or investors; to escape the control of a guild, or to replace a guild's protective cloak, when that began to grow threadbare and competition to increase. The connection between inventing and patenting is historically tentative; it only started to be firmly established in the second half of the eighteenth century.

The first four chapters examine how the patent system developed between the Restoration and 1800: the residual influences of Elizabethan practice and the monopolies controversy; the administration of patents by government

officials; the patentee's strengths and weaknesses when trying to defend his claims in the law courts. Chapters 5 and 6 draw out the implications of the system's idiosyncratic operation for the way in which patents were (or were not) used. They demonstrate how patents were sought, and granted, for a variety of reasons beyond the obvious one of protecting an invention from unlicensed imitation. The other side of this coin was that many genuine inventions were not patented. Although long recognized, it has not been fully appreciated that this varied considerably between different industries and different technologies, and that it changed over time. There were some spheres in which patenting was not cost-effective, and some types of invention less suited to patent protection. As the structure of industry changed, particularly as it became more centralized and more heavily capitalized, these factors could alter and prompt a higher ratio of patenting to inventing. An analysis of the distribution of patents by the place of residence and the occupation of patentees, in chapter 7, makes this apparent. Chapter 8 draws these findings together, to explain both the short-term fluctuations of the patent figures and their late-eighteenth-century 'take off'. The final three chapters are distinct from the exploration of the patent system in the first eight. In chapter 9, by examining the rationales offered by patentees for their inventions, I offer a new perspective on the goals of eighteenth-century inventors, and suggest that there was less interest in saving labour than is often thought. Chapters 10 and 11 move from economic activity to economic ideas, first to explore what contemporaries thought about the patent system and why they promoted alternative schemes of reward for inventors; secondly, to chart the change in perception of inventors and invention that occurred as Englishmen grew in technological confidence.

'English' patents covered England, Wales, Berwick-on-Tweed and, on request, the colonies and plantations. Scotland and Ireland maintained separate patent systems until 1852, and no attempt has been made to include them in this study. Union, in 1707 and 1800 respectively, led to the extension of the Statute of Monopolies to both.³⁴ Prior to Union, the crown was restrained only by prudence from granting unregulated monopolies in inventions as in other things. In seventeenth-century Scotland, however, private Acts of Parliament, giving limited terms of monopoly over inventions and new industries, were issued under the Act for Encouraging Trade and Manufactures of 1661.³⁵ Few Scottish patents were issued before 1760, and the subsequent acceleration in their use was largely produced by holders of English patents seeking to close this back door to infringement. Only seven patents were obtained for Scotland alone in the eighteenth century; 37 people with Scottish addresses took out one both north and south of the border, as did 106 people with English addresses; a further 22 resident Scots obtained solely an English patent.³⁶ Irish patents aroused less interest, especially before the Union. Eager projectors sought to extend their grants to Ireland in the wake of William III's victories, during the stock-market boom

of the 1690s, but they appear to have been exceptional.³⁷ The engineer, Robertson Buchanan, wrote from Glasgow to his agent in London, in 1813, to enquire 'whether a patent for Ireland be now advisable and if so the expense. Before the Union I recalled Mr [James] Watt told me that a patent for Ireland was of no use'. Presumably Buchanan was advised that the expense still outweighed the risk, since his next letter requested Mundell 'to obtain an English and Scotch patent. I do not suppose we shall meddle in one for Ireland.'³⁸ It became a major complaint that protection for all three countries had to be purchased separately and was secured only at the expense of over £300.

Although the focus of this study is England and I have accordingly used the adjective 'English', it should be remembered that several of the major protagonists were Scottish, not least the inventor-engineers James Watt and John Rennie, and the economists David Hume, Adam Smith and Dugald Stewart.³⁹ The male gender is used throughout in referring to patentees, not through inadvertence, but because ninety-nine per cent of them were indeed male.⁴⁰